Ontario

SMOG ALERT

A Municipal Response Guide

Smog Alert
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Ontario Ministry of the Enviroment
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TABLE OF CONTENTS

INTRODUCTION

Every year, people throughout Ontario look forward to the warm weather of spring and summer. But too often, our nicest weather arrives with an unwelcome companion, known as smog — a murky, brown haze that taints the landscape and fouls the air we breathe. Smog is the result of interaction between pollutants in the atmosphere and the weather.

Smog is certainly unsightly. But even worse, its main components — ground-level ozone, harmful gases and fine particulate matter — have serious and damaging effects on human health, commercial crops, ornamental plants and property. Unfortunately, most of the ingredients of smog are released by human activity.

When smog levels reach critical levels, two strategies are needed: protection and reduction. Immediate steps must be taken to protect the most vulnerable members of society. And we need to reduce harmful, smog-causing emissions that can make a bad situation even worse.

The Ministry of the Environment (MOE) monitors, analyzes and forecasts ambient air quality through the Provincial Air Monitoring Network. When unacceptably high levels of ground-level ozone are present or expected, the ministry issues official smog alerts. Alerts are communicated through the media, to allow residents an opportunity to take appropriate health precautions, and to warn major pollution sources that they may need to reduce their emissions. Municipalities who develop smog alert responses should give MOE the names of their smog alert co-ordinators. The ministry will notify them whenever smog alerts are issued, either by sending a fax, or via an automatic e-mail from the ministry's Web site. Alerts are also forwarded to ministry offices and medical officers of health. Air quality information is also posted on the ministry's Web site (www.ene.gov.on.ca).

Linkages between air pollutants and air issues

	Smog	Global Warming	Urban Air Quality	Acid Deposition	Health	Aesthetics
Ozone	yes	yes	yes	yes	yes	
Sulphur Dioxide	yes	yes	yes	yes	yes	yes
Carbon Monoxide			yes		yes	
Oxides of Nitrogen	yes	yes	yes	yes	yes	yes
Volatile Organic Compounds	yes	yes	yes		yes	yes
Toxic Organics			yes		yes	
Particles	yes	yes	yes	yes	yes	yes
Total Reduced Sulphur Compounds			yes		yes	yes

INTRODUCTION cont'd.

The most direct and harmful effects of smog – the damage to human health, property and the environment – are felt locally. And when smog levels become dangerously high, municipalities can play a vital role by informing their communities about the problem and facilitating local action to clear the air.

Effective local action is vital

Smog is a society-wide problem, and all levels of government have important roles to play in protecting the public by curbing smog-causing emissions. Provincial and federal efforts to combat smog are important, but the role of municipalities is vital, because it is in local communities that on-the-ground actions can be taken to clear the air and protect citizens, especially during smog alerts.

The first section of this guide outlines how municipalities can take effective action by putting local smog response programs in place. The second section contains useful background information on air quality in general and smog in particular. A list of practical smog alert workplace actions is included for your use. It can be modified and augmented according to individual circumstances.

The most important outcome from this guide, however, will be a sharing of best practices between the different levels of government and among municipalities — acknowledging that some municipalities are already far ahead in their air quality efforts. As part of this sharing, we encourage you to send us your comments on this guide. We plan future editions that will benefit from your input. You'll find the address to write to on the inside front cover, or contact us via e-mail at the ministry Web site.

PART I

A GUIDE FOR MUNICIPAL ACTION

PART I – A GUIDE FOR MUNICIPAL ACTION

Municipalities have an important role

Municipalities can play a key role in the local response to a smog alert. By taking prompt action to inform municipal staff and the community at large of the smog situation, municipal staff can help curb smog-producing emissions. Even more important, municipal early-warning efforts can ensure that those community members who are most at risk will be informed in advance so that they can take the necessary precautions to protect their health.

Every Ontario community, and particularly those located in the southern part of the province, should be involved in reducing smog-producing emissions and informing people with respiratory illnesses in advance of serious smog episodes. Municipal and regional governments have key roles to play in reducing emissions of smog-producing pollutants at all times, but most importantly during official provincial smog alerts.

The essence of an effective response to a smog alert is communications, and municipalities are closest to the front line. As the contact point for the local communities they serve, they have a vital role to play in getting the word out to vulnerable people, hospitals and health workers, seniors' homes, schools, area businesses and local industries. Public education and effective communications are vital to an effective smog alert response.

Municipalities can also implement a range of internal measures to reduce or eliminate their contribution of nitrogen oxides (NO_x), volatile organic compounds (VOCs) and particulates to the environment. For example, suspending tree-cutting, lawn-mowing and the use of oil-based paints can significantly reduce local emissions. Where possible, reducing the use of trucks and other heavy equipment can also help. A more complete list of internal actions is provided as an appendix.

Establishing a local smog response policy

Getting a smog response program off the ground begins with local commitment to developing and implementing an effective local policy, and integrating it into a municipality's or region's day-to-day operations. By establishing a smog response policy, municipal and regional councils ensure the process of responding to a smog alert is instituted. They also provide their staffs with a mandate for local action.

Developing a smog alert response policy

After a smog response policy has been established, local councils need to support the process by encouraging local business and industry to reduce their emissions of smog-producing chemicals, and by encouraging municipal organizations, community leaders and constituents to suspend or curb those activities that add to the smog problem. With council's support and an effective policy in place — one that clearly describes the actions to be taken by municipal staff during smog alerts — the response program is assured of a solid foundation.

Internal activities

Municipalities can implement a range of internal activities to reduce the effect of municipal operations and staff activities on poor air quality. Such actions include suspending tree-cutting and lawn mowing, painting and road paving operations, minimizing the use of trucks and other heavy equipment, and establishing a car pool program for staff during smog alerts.

The smog alert response committee

To ensure an effective municipal response, MOE recommends creating a senior-level committee representing all municipal departments. The committee can be given responsibility for developing a smog alert response procedure to ensure the program's effectiveness. A senior-level committee also helps encourage and support the participation of all employees.

Assigning a response program co-ordinator

Once a smog alert response committee is in place, the next important step is to assign a staff member the responsibility of co-ordinating the development of the local response program. The response program co-ordinator should have a clear mandate, with enough autonomy and authority to make program-related decisions and communicate regularly with senior management. (Often, municipalities assign the task of developing and co-ordinating the air alert response program to the senior staff person with responsibility for municipal environmental matters.)

To be effective, the response co-ordinator will require communications support. In larger municipalities, this will mean support from a communications department. In smaller municipalities, it will mean support from a communications staff person, whether full-time or on call. Public education and an efficient communications process during a smog alert are the key elements of a successful response.

Staff training

Once a co-ordinator has been assigned, the next step is to set up staff training strategies, including training sessions, to ensure that all municipal employees recognize the importance of responding to a smog alert, and understand their respective roles. Employees need to understand how they can help reduce the negative environmental effects of their actions and activities — both as employees and at home in their personal lives — during a smog alert. To ensure an effective response, the objectives and actions of the municipality's smog alert response program must be clearly understood by all staff.

The training sessions should take about two hours and involve a maximum of 30 staff per session. Training sessions should also be used to encourage staff to contribute ideas, suggestions and assistance in implementing the program in their work places. It takes only a few people helping out, or participating in car pools or bike-to-work days, to get others motivated to do the same, or discover their own unique ways of contributing.

It is also advisable to request employee input on the best way to take necessary actions during a smog alert, since those who carry out the activities are in the best position to provide advice on potential problems and solutions that work. As well, giving employees an opportunity to contribute to the development of the program makes them more likely to embrace it, and carry the positive actions and activities into their personal lives.

Notifying internal departments

Under the local smog response program, a contact person should be identified for each municipal department. The contact person is normally the first person in the department notified by the program co-ordinator of a smog alert. The contact person is then responsible for informing staff in his or her department of the situation.

Because smog episodes typically occur during the warmest seasons, they generally coincide with the most popular times for staff vacations. That means identifying backup contact people for each department is a must.

If clear response guidelines and an effective communications procedure are in place and understood, implementation of the smog alert response program should not have an adverse effect on municipal operations. To get to that point, however, all staff must clearly understand their roles in the program, and the actions that each department is expected to take during a bad air episode.

Developing an action list

During the development of the smog response program, each municipal department should list the actions it can take to minimize the release of smog-producing pollutants. The list should be as comprehensive as possible, but it must also be realistic and workable. A sample list is provided as an appendix to this guide.

Once the action list for each department has been formalized and adopted by staff, management and the smog alert response committee, the list should be printed and made available to all staff. A letter from the municipality's chief operating officer or department director endorsing the list will help reaffirm the municipality's commitment to smog reduction. It may also be a good idea to display the action list in each department for easy reference.

Maintaining awareness

Keeping employees informed and providing regular reminders of the need for all staff to do their part to help reduce harmful, smog-producing emissions is an important way to ensure the ongoing success of the smog response program. Posters, e-mail messages, screen savers, lobby displays, phone stickers, voice-mail reminders, newsletter articles and regular updates at staff and departmental meetings can all help keep staff enthusiastic, aware and informed.

Encouraging staff participation

There are many ideas for getting employees enthused about taking individual actions to reduce smog-producing emissions. Special events, employee recognitiondays, smog buster awards and individual, departmental or office competitions are examples of effective ways of encouraging staff participation and "buy-in."

External activities – issuing a local smog alert

A smog alert is designed to give residents in the affected areas advance warning of impending air pollution levels that could pose a risk to their health. A clear and comprehensive communications plan is therefore vital if municipal and regional governments are to notify local health care facilities, schools and educational facilities, industrial and commercial operations and individual residents about the practical actions that they need to take during the alert.

There are three main reasons for issuing a smog alert:

- ***first,*** to provide advance warning to as many members of the public as possible in the affected area so that they can take appropriate action to protect their health and the health of their families;
- ***second,*** to encourage the owners or operators of local pollution sources — from large industries to private and commercial vehicles to lawn mowers and barbecues — to reduce the release of smog-related emissions that can make local problems worse; and
- ***third,*** to position the municipality and the local Ministry of the Environment office as reputable sources of additional information on smog problems and related environmental and health issues.

Steps to establishing a smog alert response program

Step 1 Establish a smog alert response policy.

Step 2 Set up a committee to help manage the smog alert response procedure.

Step 3 Appoint a co-ordinator and provide communications support.

Step 4 Give the Ministry of the Enviroment the name and contact process (fax number or e-mail address) to be used by the ministry for smog alert advisories.

Step 5 Train staff, ensuring all employees are informed and invited to make recommendations.

Step 6 Ensure required smog response actians for each department are well understood, clearly listed and displayed for easy reference.

Step 7 Use posters, electronic messages and other visual and verbal reminders to keep staff aware of the process and the need far everyone to participate — professionally and personally.

Step 8 Hold special events and friendly competitions to keep staff mativated and eoger to contribute.

Step 9 Review the experiences of the last smog season to see where your response program can be improved.

Contents of the smog alert

Ideally, notification of a local smog alert should provide members of the public with basic information on the situation, including:

- the smog alert process;
- the health and environmental implications of high ozone levels (see "Smog effects on human health" and "Other harmful effects of smog" in part two of this guide);
- recommended actions in the event that employees or family members exhibit symptoms of ozone exposure; and
- how to minimize emissions of ozone precursors and other smog-related pollutants that could make local air quality problems worse.

Planning an effective municipal response to a regional smog alert should not require a significant allocation of resources or staff time. But an effective response does require careful organization, and a commitment at the highest levels of the municipality to managing the response program effectively.

Notifying the community

When a smog alert is issued, a checklist of local groups, facilities and organizations should be contacted directly with specific information about anticipated ozone levels, the expected duration of the pollution episode, and its potential adverse health effects. Those contacted should also be given background information on recommended actions to minimize exposure to smog, as well as steps that can be taken to reduce emissions of air pollutants that may further degrade local air quality.

The specific list of community contacts will vary in each location, but a typical list consists of the following groups, facilities and organizations:

- local media — including radio, television and daily press outlets;
- local health care community — including public and general hospitals, chronic care hospitals, mental health facilities, nursing homes, homes for the aged, walk-in clinics and any other health care facilities offering emergency care;
- local educational community — including public and private institutions, such as elementary, secondary and vocational schools, training academies, post-secondary colleges and universities, company training centres, summer schools and camps, day-care centres and local health organizations;
- other institutions — such as correctional facilities;
- local industries and commercial organizations — including coal- or oil-fired electricity generating facilities, other coal- or oil-fired process steam generating facilities, incinerators, manufacturing industries, petroleum refining operations, chemical industries, primary metals industries, mineral processing industries, the grain industry, glass industries and the paper and allied products sector;
- local transportation sector — including public transit authorities, delivery and cartage services, trucking fleets, taxis and livery operations, garbage and recyclables collection, emergency vehicle services, and auto body repair and painting shops.

Making contact

Using available directories, municipal records, Ministry of the Environment files and other resources, the municipality should identify local media outlets, health care facilities, educational organizations, and major industrial and commercial sources of air pollution. The media list should include local news directors and reporters with an interest in the environment. The list should always be comprehensive and up to date, and include all individuals, groups, facilities and organizations that are to be notified of the smog alert.

NOTES:

PART II

SMOG: A SERIOUS ENVIRONMENTAL AND HEALTH PROBLEM

PART II — SMOG: A SERIOUS ENVIRONMENTAL AND HEALTH PROBLEM

Smog's effects on human health

Ozone is a lung irritant that attacks the throat and airways, causing inflammation that can last for up to 18 hours after exposure. Exposure to excessive ozone levels can cause coughing, wheezing and tightness of the chest, and aggravate existing heart and lung conditions.

Smog's effects on human health relate directly to the duration and intensity of exposure. In general, the more smog we breathe in, the more likely we are to experience adverse health effects. The fact is, however, that people's sensitivities to smog vary a great deal.

Pollutant	Characteristics	Sources	Ontario Criteria	General Health Effects	General Ecological Effects
Ozone (O_3)	A colorless gas with a strong smell. Major component of summer smog	Ozone is not emitted directly into the atmosphere It is produced by photochemical action on nitrogen oxides and volatile organic compounds	1 h average 80 ppb	Irritation of the lungs and difficulty in breathing. Exposure to high concentrations can result in chest tightness, coughing and wheezing	Damage to agricultural crops, ornamentals, forests and natural vegetation.
Total Suspended Particles (TSP)	Particles of solid or liquid matter that stay suspended in air in the form of dust, mist, aerosols, smoke, fume, soot, etc. Size range 0.1-100 microns.	Industrial processes including combustion, incineration, construction, metal smelting, etc. Also motor vehicle exhaust and road dust. Natural sources such as forest fires, ocean spray and volcanic activity	24 h average 120 µg m^3 1 y average 60 µg m^3	The smaller the particle the greater the effect on health Significant effects for people with lung disease, asthma and bronchitis. See PM_{10} below	Damage to vegetation, deterioration in visibility and contamination of soil.
Inhalable Particles (PM_{10})	Same as TSP except size range of particles is less than 10 microns.	Same as TSP	24 h average 50 µg m^3	Increased hospital emissions and premature deaths	Same as TSP.
Total Reduced Sulphur (TRS)	Offensive odors similar to rotten eggs or cabbage	Industrial sources include steel industry, pulp and paper mills and refineries. Natural sources	1 h average 27 ppb (kraft pulp mill)	Not normally considered a health hazard They are the primary cause of odors.	
Sulphur Dioxide (SO_2)	Colorless gas with a strong odor similar to burnt matches	Electric utilities and non-ferrous smelters Also primary metal processing, iron ore smelters, pulp and paper, petroleum refineries, etc	1 h average 250 ppb 24 h average 100 ppb 1 y average 20 ppb	Breathing discomfort, respiratory illness, aggravation of existing respiratory and cardiovascular disease. People with asthma, chronic lung or heart disease are most sensitive to SO_2.	Leads to acid deposition, which causes lake acidification, corrosion and haze. Damage to tree leaves and crops
Nitrogen Dioxide (NO_2)	Gas with a pungent and irritating odor	Automobiles, thermal power plants, incineration, etc Natural sources include lightning and soil bacteria	1 h average 200 ppb	Increasing sensitivity for people with asthma and bronchitis	Leads to acid deposition: adverse effect on vegetation.
Carbon Monoxide (CO)	Colorless, odorless, tasteless and poisonous gas	Major source is transportation sector, i.e., road vehicles, aircraft and railways	1 h average 30 ppm 8 h average 13 ppm	Impairment of visual perception, work capacity, learning ability and performance of complex tasks.	

The most vulnerable members of our society — elderly people, children, those with heart and respiratory problems, and even healthy adults who are highly sensitive to ozone — can experience adverse ozone-related health effects after spending only an hour or two outdoors.

There is evidence that excessive exposure to ozone can heighten the sensitivity of asthma sufferers to other common airborne allergens. Particles that are small enough to be inhaled — especially very fine or ultra-fine particles that can penetrate deeply into the lungs — are also known to have adverse health effects.

The bottom line is that smog and its components aggravate a wide range of health problems — problems that are especially acute for people who suffer from respiratory illnesses such as chronic bronchitis and asthma, and for those who suffer from cardiac problems.

Health studies indicate that more people with respiratory problems are admitted to hospital during periods of high ground-level ozone, and other studies have linked higher death rates to exposure to inhalable particulates.

Younger children are particularly vulnerable to ground-level ozone and ultra-fine particles, since they tend to spend more time outdoors, and their developing respiratory systems work harder and take in comparatively more air than an adult's lungs.

In fact, there is a growing body of medical evidence that suggests even relatively low levels of ozone can have an adverse effect on health. Recent studies indicate that there may not be any absolutely safe level of exposure for either ground-level ozone or airborne particles.

Other harmful effects of smog

The ground-level ozone that forms smog is one of the atmosphere's most damaging pollutants. Ontario's environmental standards for ozone are set at a level designed to protect the most sensitive crops from visible leaf damage, but lower concentrations of ozone can also reduce the yield of some crops, blight ornamental plants and stunt tree growth. Cumulative exposure to ozone throughout the growing season is believed to cause significant damage to Ontario's agricultural and forest industries.

Ozone can also damage synthetic materials — causing cracks in rubber, accelerating the fading of dyes, speeding up the deterioration of some paints and coatings, and affecting cotton, acetate, nylon, polyester and other fabrics.

The benefits of reducing smog

Smog is a nasty, unsightly by-product of our society, but reducing smog is more than a quality of life issue. For some people, reducing smog can be a matter of life and death. And while there are many good reasons to reduce smog, the most important one is that reducing smog levels can have direct benefits for human health.

The Ministry of the Environment has estimated that a 45 percent reduction in smog-producing NO_x and VOCs could save some 180 lives a year in Ontario, and also result in some 190 fewer cardiac and respiratory hospital admissions, 200 fewer emergency room visits for asthma, and between three and four million fewer episodes of acute respiratory and asthma days.

In addition to reducing illness and saving lives, reducing smog will lead to lower health care costs. And while it is difficult to measure accurately the full cost of the environmental damage caused by smog, excessive ozone levels are thought to cost Ontario farmers some $70 million a year through reduced crop yields and related problems.

Ozone: good up high — bad nearby

Ozone can be either good or bad, depending on where it exists in the earth's atmosphere. In the stratosphere, ozone is beneficial. In the troposphere, closer to earth, ozone is harmful.

Stratospheric ozone is produced when radiation from the sun splits oxygen molecules, which re-combine to form ozone (O_3). Stratospheric ozone — located in the earth's upper atmospheric layer, between 16 and 50 kilometres above the ground — is considered "good" ozone, since it filters the sun's harmful ultraviolet (UV) rays and protects people from sunburn and skin cancer.

By contrast, tropospheric ozone is produced by the combination of NO_x and VOCs in intense sunlight. Tropospheric ozone — located anywhere from ground level to 16 kilometres above the planet — is considered "bad" because of the damage it does to human health and the environment.

While some ground-level ozone is always present in the air we breathe, excessive levels most often occur under four simultaneous conditions:

- when the air temperature is at or above 300 Celsius (860 F);
- when the solar radiation index is high;
- when there is little or no wind; and
- when NO_x and VOCs are present in the air.

Understanding the difference between good ozone and bad ozone is the first important step toward protecting the good and minimizing the bad. Smog is a human-caused problem, so it's up to people to take effective action to ensure that "bad air days" are a lot less frequent in future.

Understanding Ontario's smog problems

In 1996, a research study ranked the City of Toronto among the world's cleanest cities, with low levels of sulphur dioxide, carbon monoxide and inhalable particles. Toronto was also in the top half of the cities surveyed for levels of ozone and nitrogen dioxide.

Nevertheless, air quality is still a major issue that we must continue to address.

Excessive ground-level ozone is the most frequent cause of poor air quality. While emissions of other major air pollutants have decreased significantly in recent years, average ozone levels remained fairly constant in Ontario between 1986 and 1995. Fine particles in the air also represent a significant health concern and contribute to the formation of smog. And as with ozone, particulate levels in Ontario have not changed significantly during the last 10 years.

Ground-level ozone and fine particulates are the primary ingredients of the dirty brown haze we know as smog. (Smog is a coined word created by combining two other words — "smoke" and "fog.") From late spring through to early fall, when the weather is hot and sunny, ground-level ozone is the leading component of smog. During cooler months, inhalable particulates comprise a higher proportion of the smoggy mix.

THE MAJOR COMPONENTS OF SMOG

Nitrogen oxides (NO_x), a family of generally colourless and odourless gases (with the exception of nitrogen dioxide), are emitted from many sources including motor vehicles, power plants, incinerators and a wide range of industries. High levels of NO_x irritate the lungs and can cause coughing, dizziness and headache. NO_x emissions also contribute to smog, acid rain and global warming.

Volatile organic compounds (VOCs) are released from a variety of sources including solvents and paints as they are being produced and used, motor vehicles being operated and wood while it is burning. The health effects vary according to the compound and range from relatively non-toxic chemicals to dangerous neuro-toxins and carcinogens. VOCs are also among the precursors of ground-level ozone and smog.

Ozone (O_3), a colourless gas with a sharp electrical smell, is highly unstable and very reactive. A key ingredient in smog, ozone attacks the lungs and respiratory tract and, depending on the concentration and a person's sensitivity, may cause coughing and other breathing problems, watery eyes, headache, reduced vision, fatigue and difficulty concentrating. Ground-level ozone is formed when NO_x and VOCs react together in strong sunlight.

Particulates are usually classified according to size. Inhalable particulates, known as PM10, are smaller than 10 microns in diameter and are composed primarily of soil, soot and dust from construction and roadways. The respirable particulates (PM2.5) are smaller still — less than 2.5 microns in size — which means they can be drawn into the deepest parts of the lungs. The PM2.5 fraction is derived primarily from common air pollutants, such as sulphur dioxide, NO_x and VOC , which are chemically converted into ultrafine particles of sulphate, nitrate and organic compounds, or into minute liquid droplets of acid. High concentrations of particulates are responsible for the dirty haze of smoggy days.

Nitrogen dioxide (NO_2) is a toxic red-brown gas with an irritating odour and is emitted by all combustion processes. NO_2 can irritate the lungs and lower resistance to respiratory infection. It can also damage materials and vegetation. When combined with water, NO_2 forms acid rain. It is also a component of smog and contributes to the formation of ground-level ozone and particulate matter.

Sulphur dioxide (SO_2) is a colourless gas with a pungent, distinctive odour. Exposure to high concentrations of SO_2 can cause breathing discomfort, respiratory illness and the aggravation of existing lung and heart disease. SO_2 can also be chemically transformed into acidic pollutants and fine particles, both of which pose health risks. The main sources of airborne SO_2 are coal-fired generating stations and non-ferrous ore smelters.

Carbon moxoxide (CO) is a colourless, odourless and tasteless gas that is released by combustion processes and found in automobile emissions. CO in the bloodstream can impair the transfer of oxygen to the organs and tissues of the body. High concentrations can cause blurred vision, clumsiness and even death. Lower levels can cause discomfort for people with heart or lung disease.

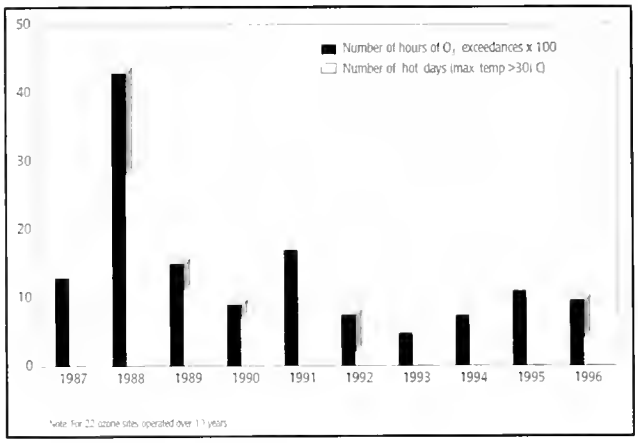
The major sources of smog

Most smog-producing air pollutants in Ontario are released as unburned by-products of the gasoline, coal and natural gas we use in vehicles, homes and businesses, industrial boilers and power plants. Smog "precursors" are also released by industrial processes, in the evaporation of liquid fuels, and in the use of solvents and other volatile products, such as oil-based paints.

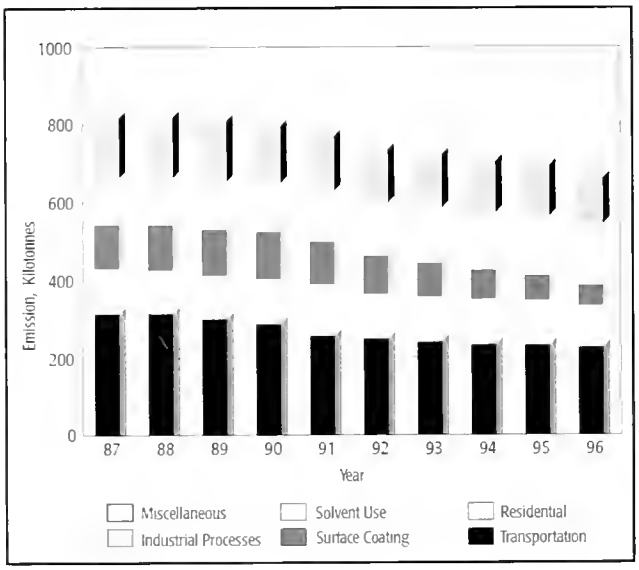
Fine dust and ash are also blown up from roads, construction sites and agricultural areas, and these particulates contribute to Ontario's smog problems. There are some natural sources of smog, too — forest fires produce NO_x, for example, and some VOCs are released by trees — but human activities are mainly responsible for the significant increases in ground-level ozone documented across Canada in recent years.

Smog originates both locally and outside Ontario. On hot summer days, for example, more than 50 percent of the smog-causing ozone that affects Ontario is carried here on the wind from the United States. Still, almost half of the problem originates right here in Ontario. And it's our domestic contribution to the smog problem that we need to start addressing more effectively.

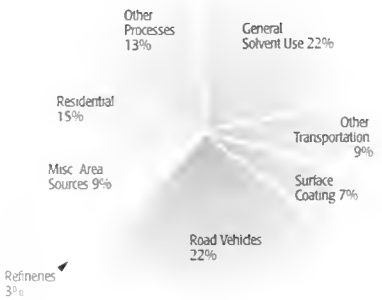
10-Year Trend for Ozone Exceedances and 'Hot' Days (1987 - 1996)



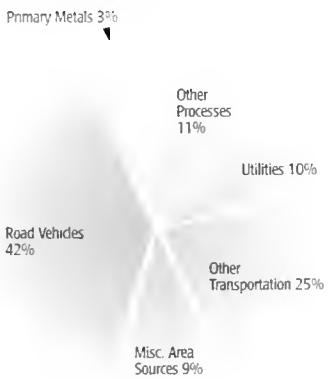
Trend for Ontario VOC Emission Estimates (1987 - 1996)



Ontario VOC Emissions by Sectors
(Emmissions from Human Activity, 1996 Estimates)



Ontario Nitrogen Oxides Emissions by Sectors
(Emmissions from Human Activity, 1996 Estimates)



Smog and geography

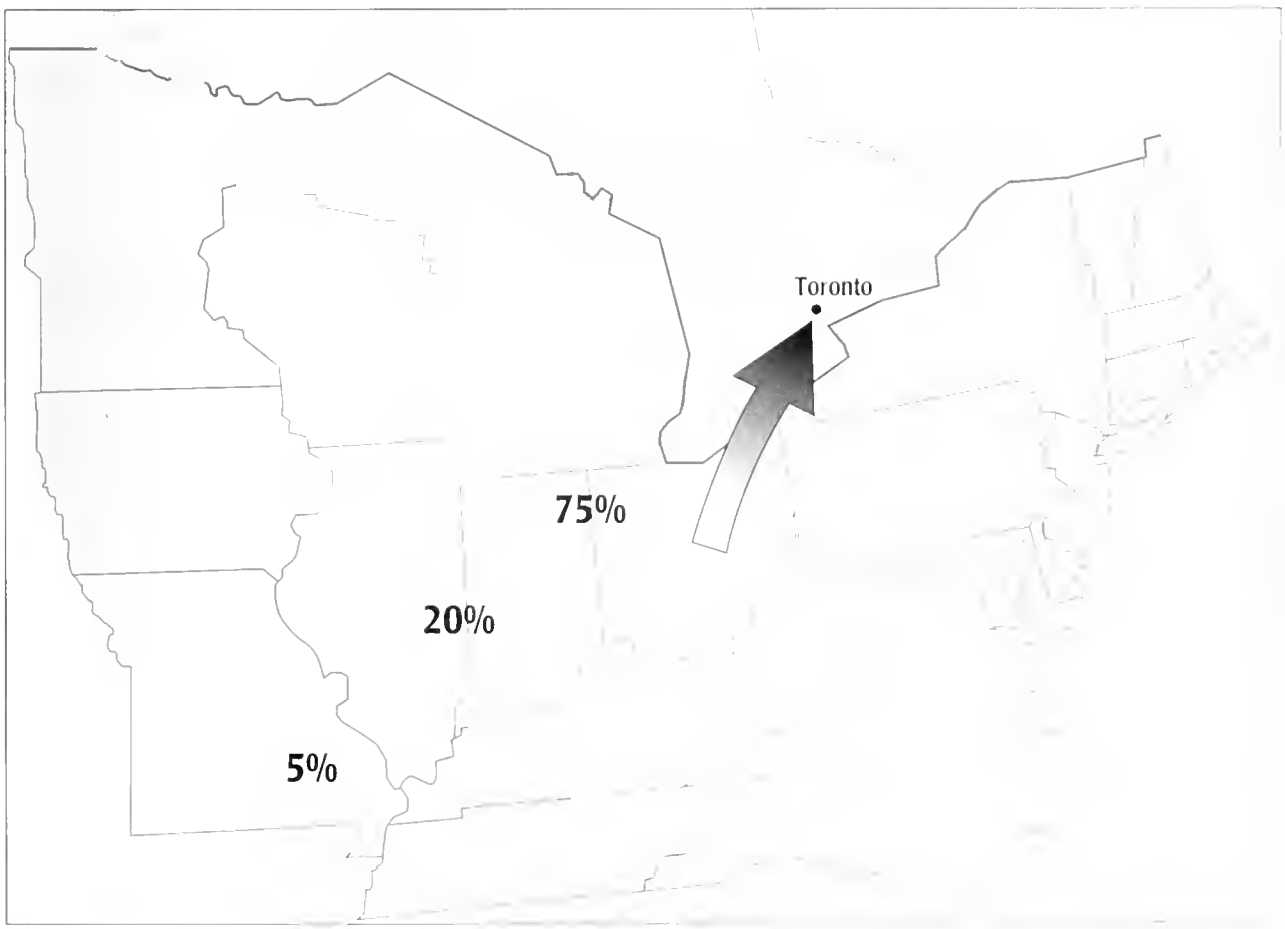
In Ontario, the pollutant that exceeds the provincial ambient air quality criterion (AAQC) most often is ground-level ozone. In 1996, for example, Ontario's one-hour ozone criterion of 80 parts per billion was exceeded at 40 of 43 monitoring stations. At those levels, people with heart and lung problems were at serious risk, and even healthy people who were engaged in vigorous exercise may have experienced smog-related symptoms.

Ontario's highest ozone and smog levels normally occur in the southwestern and south-central parts of the province, due to local pollution sources and smog generated in the United States. As a polluted air mass moves northeast from the U.S. over the Great Lakes, smog precursors interact in the presence of sunlight, and the concentration of ozone increases.

High ozone levels are measured most frequently in Ontario at Long Point on the north shore of Lake Erie, and at Tiverton on the eastern shore of Lake Huron. As the smoggy air passes over forests and farmland, the ozone reacts with the soil and vegetation, and levels slowly drop.

But in the environment, where everything is connected, southern Ontario communities receive smog-causing pollutants that are released by cars and industrial facilities in the Ohio valley (see map — U.S. source regions of trans-boundary ozone). In the same way, Quebec and Atlantic Canada are the downwind recipients of pollutants that come from Ontario's vehicles, power plants and other sources.

U.S. source regions of trans-boundary ozone



Smog and the weather

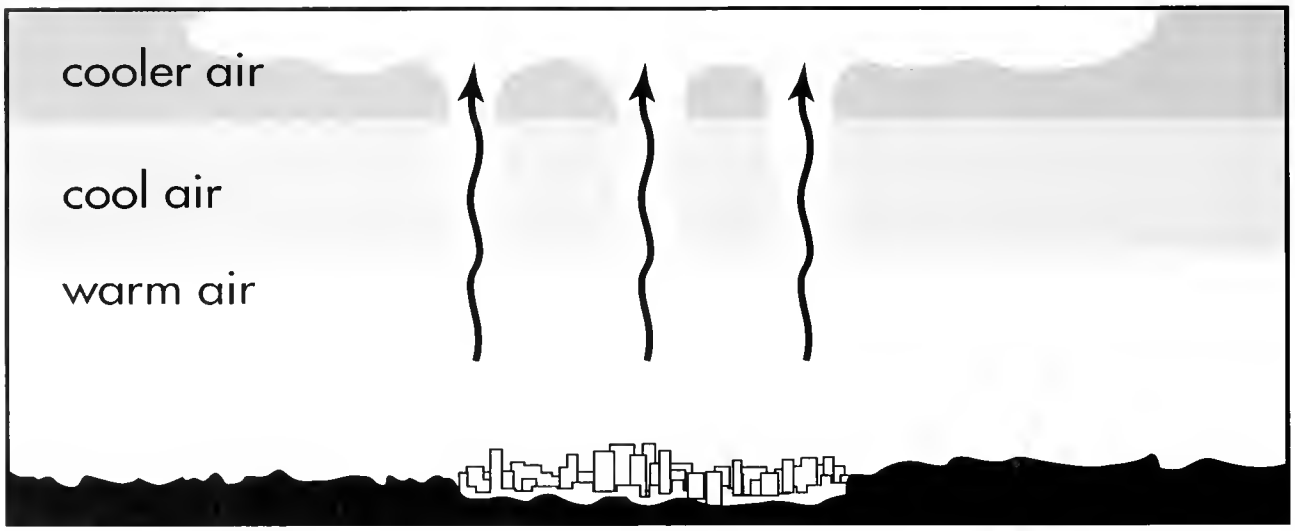
Smog levels are strongly influenced by the weather, and the best conditions for the formation of ground-level ozone and smog are when temperatures are near or above 30°C (86°F), when winds are light and there are few clouds.

In the summer, when it is hot, dry and sunny, ozone levels are often at their highest. They tend to peak in the mid- to late-afternoon, when the intense sunlight has had a chance to "cook" vehicle exhaust and industrial emissions. Ozone levels can drop rapidly in the evening once the sun goes down.

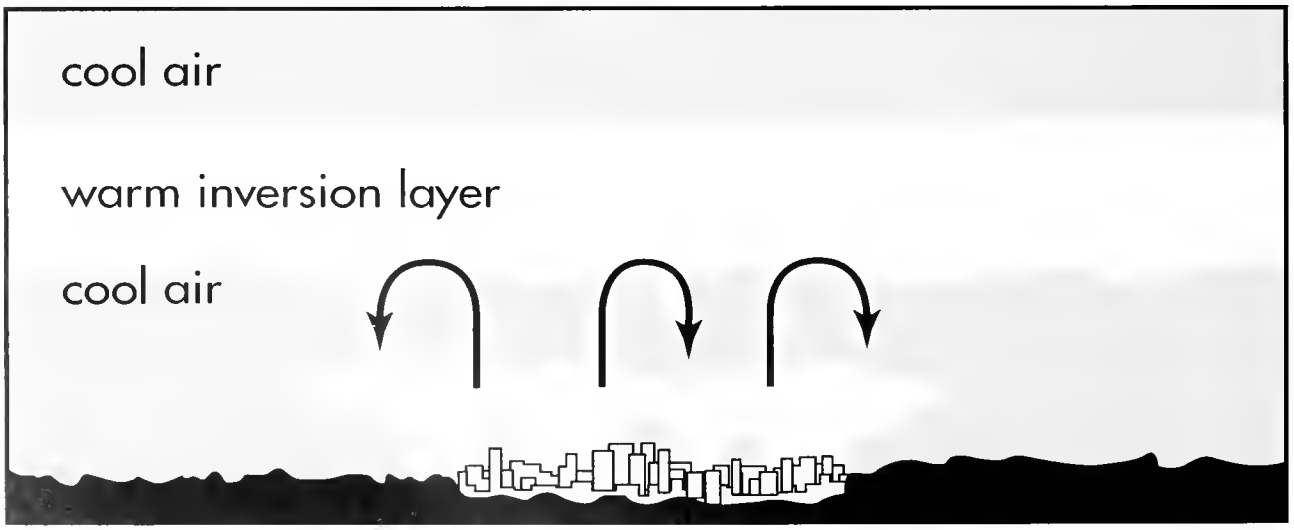
In general, urban particulate levels in smog tend to rise during the week, when traffic and industrial activity are highest, and drop off over the weekend. Temperature inversions and other climatic conditions can also trap stagnant, smoggy air over a region for days at a time.

Ontario's "smog season" usually lasts from May to September. Over the winter, inhalable particulates, rather than ozone, tend to be the main component of smog.

Normal pattern



Temperature inversion



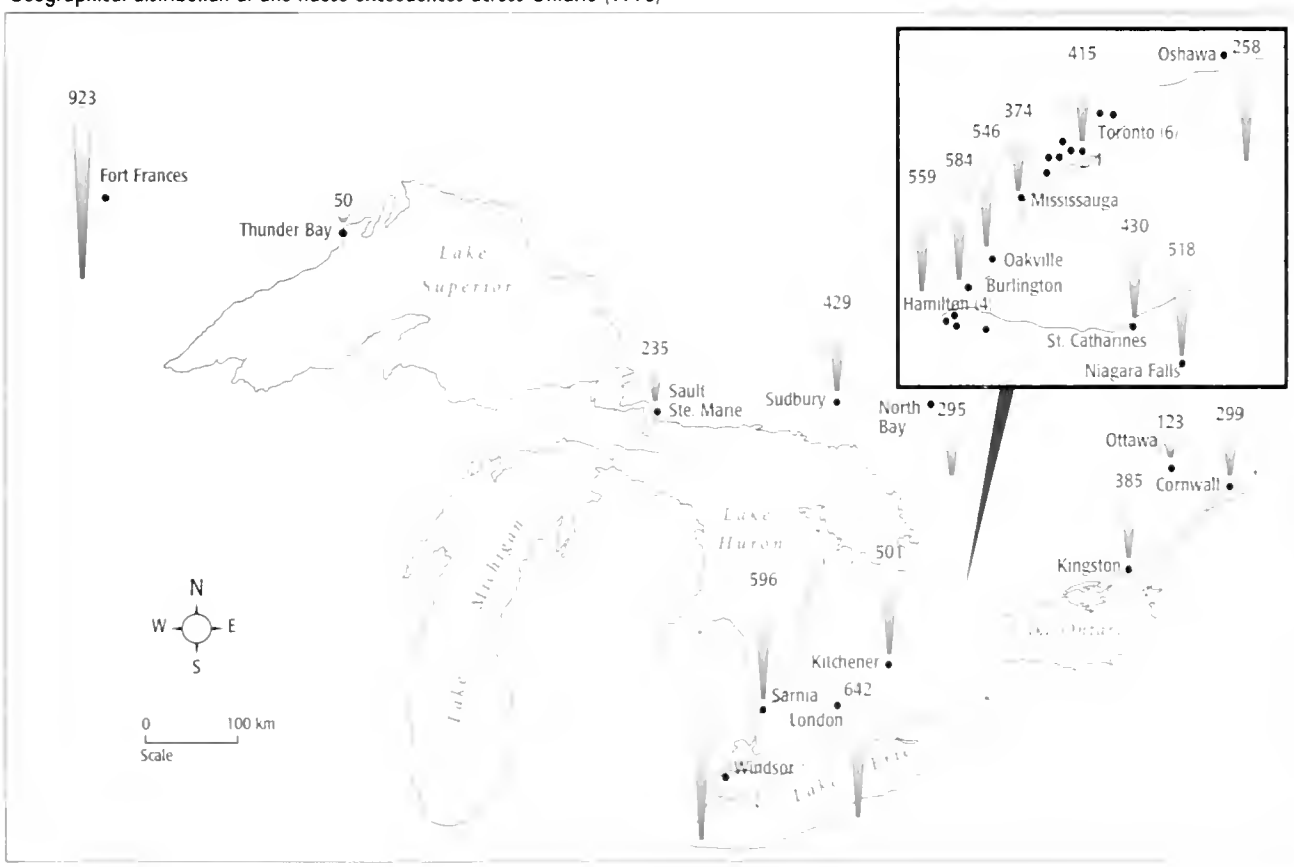
Measuring and reporting smog in Ontario

The severity of smog is measured by the concentration of pollutants in the air. That concentration is usually expressed either in micrograms of the contaminant per cubic metre of air, or in parts per billion (ppb) of the pollutant, averaged over a given period of time. Air pollution is measured at Ontario's network of air sampling stations, which contain monitoring equipment that can provide real-time readings of pollutants, and take both "grab" and cumulative samples.

Ontario has invested close to $4 million since 1995 to upgrade the province's air monitoring network, making Ontario's network among the most modern and best equipped in North America. Outdated monitoring stations have been upgraded with more sophisticated equipment, and a new mobile air monitoring station has been put into service to produce accurate, real-time air pollution readings at any location.

MOE has also restructured and upgraded its environmental information system to better manage the flow of data from provincial monitoring sites. The ministry has also installed state-of-the-art continuous monitoring instruments for inhalable and respirable particulates at 23 provincial monitoring stations.

Geographical distribution of one-house exceedences across Ontario (1996)



The Air Quality Index

The air quality index (AQI) is a tool produced by the Ministry of the Environment designed to assess air quality at specific locations and its possible effects on human heath.

The AQI is mainly a public information device, used to inform residents about local ambient air quality conditions. To calculate the AQI, the ministry monitors the airborne concentration of several major pollutants, including carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide, suspended particles and total reduced sulphur compounds. The monitoring is conducted at 27 locations in 19 Ontario cities.

Each pollutant is measured separately, averaged over one hour, and compared to a critical standard in order to calculate a sub-index value for the location. The hourly AQI value is based on the pollutant that is most severe at that particular hour.

Several pollutants included in the AQI come mainly from vehicles and domestic fuel consumption, or are carried into Ontario from sources outside the province's jurisdiction. Since none of these sources is subject to immediate provincial control, the AQI is not used as a tool to prevent air pollution.

In 1996, Ontario's air quality index reported good to very good air quality readings 95.3 per cent of the time. Ground-level ozone and inhalable particles, which are the major components of smog, were the two pollutants that most often exceeded the provincial air quality criteria.

1. 0 to 15 indicates very good air quality
2. 16 to 31 indicates good air quality
3. 32 to 49 indicates moderate air quality
4. 50 to 99 indicates poor air quality
5. 100 and above indicates very poor air quality

Provincial smog alerts

The Ministry of the Environment, in conjunction with Environment Canada, has developed a special program to warn Ontario residents when unacceptably high levels of ground-level ozone are either present or expected. The province can issue an official smog alert any time from the end of April through to mid-September when provincial forecasts indicate widespread occurrences of ground-level ozone in excess of 80 ppb. New computer modeling technology and enhanced analysis equipment allow the ministry to issue earlier warning of impending smog episodes.

Alerts are issued through the media, often during radio and television weather forecasts, in the late afternoon of the day before an ozone episode is expected. This allows residents an opportunity to take appropriate health precautions, and warns major pollution sources that they may need to reduce their emissions. Alerts are also filed at local ministry offices and on the ministry's Web site (www.ene.gov.on.ca).

From 1993 to 1998, MOE issued a total of 18 official alerts — three in 1998 (covering a total of eight days), three in 1997 (covering a total of six days), three in 1996 (covering a total of five days), six in 1995 (covering 11 days), twice in 1994 (covering a total of six days) and once in 1993 (for one day). The number and duration of official smog alerts depend to a great extent on weather conditions between May and September.

CONCLUSION

Smog is an unpleasant fact during some of Ontario's most pleasant weather. In southern Ontario communities that are prone to high smog levels, poor air quality poses a serious health risk for the most vulnerable members of our society — including young children and elderly people, and those who suffer from respiratory and cardiac problems. In fact, smog can also have adverse health consequences for Ontario residents who are ordinarily quite healthy.

While the federal and Ontario governments are working to reduce Ontario's smog problems in the future, effective municipal action remains the key to coping with smog in the short term.

The Ministry of the Environment has prepared this guide to help municipal and regional officials develop and implement an effective smog response program — both to protect the most vulnerable members of their communities and to minimize the contribution their own operations may make to local smog episodes.

We hope that you have found this publication informative and useful, and we would welcome your input on how to make it even better. For more information on responding effectively to smog problems, or to provide comments on this publication, please contact the ministry at the address shown on the inside cover.

Appendix: SMOG ALERT WORKPLACE ACTION LISTS

Some of the actions in this list are for long-term smog prevention.
Others are specifically recommended for smog alert days. They are all good for the air we breathe.

Transportation

- Use alternative fuel-powered fleet vehicles and identify them with a bumper sticker.
- Encourage employees to use green fleet vehicles identified by bumper stickers.
- Establish a routine of regular inspections to ensure all vehicles are well tuned and operating efficiently.
- Encourage employee car or van pooling by providing preferential parking spaces or by subsidizing parking fees.
- Encourage employees to bicycle to work by providing secure bike racks and shower facilities.
- Encourage employees to use public transit by providing free transit tokens on smog alert days and subsidizing transit passes throughout the year.
- Establish an anti-idling policy for municipal vehicles.
- Encourage schools, hospitals and day-care facilities to establish anti-idling drop-off/pick-up zones.
- Do not refuel municipal vehicles on smog alert days and do all refueling after 4:00 p.m. on other days.
- Put a time of day column in the fuel section of the vehicle transportation log as a reminder to employees to refuel fleet vehicles after 4:00 p.m.
- Include a pressure gauge with the transportation log and request that employees check and record tire pressure every 1000 kilometres.
- Encourage employees not to refuel personal vehicles on smog alert days.
- Use telecommuting in place of commuting to meetings.
- Establish compressed work weeks or flex time during smog season to reduce vehicle use in general or during periods of peak road congestion.
- Have a special smog alert lunch menu offered in the cafeteria to encourage employees to stay in and avoid driving at lunch time.
- Replace vehicle gas caps that have broken seals or stripped threads.

- Encourage staff not to drive fleet or personal vehicles with extremely low fuel levels, since this increases tail pipe emissions.
- Encourage employees to plan outside activities and errands to reduce driving time.
- Avoid using motor vehicle courier services on smog alert days — use fax, e-mail, bicycle couriers.
- Encourage employees to use vehicle air conditioning only when necessary and only on long trips.
- Avoid unnecessary weight in the trunk/bed of vehicles/trucks as the extra weight reduces fuel efficiency.
- Provide shaded or indoor parking areas to avoid evaporative emissions — plant trees around open, outdoor parking lots to create shade.

Maintenance

- Do not use oil-based paints on smog alert days.
- If you must paint on smog alert days substitute water-based paints for oil-based paints.
- If you must use oil-based paints, stains or sealers, be sure they are identified as having a low VOC content.
- If large painting projects must be conducted during smog season, the job should be performed between 4:00 p.m. and 11:00 p.m. (VOCs are less reactive during the cooler periods of the day and will have time to dissipate before the next day).
- Replace windows and glass entry doors with low-E, argon gas-filled windows and doors. (These energy efficient windows and doors keep the heat out during smog season and in during the winter months).
- Establish a fuel tank inspection program to identify leaks and maintain fuel tanks to specifications.
- Schedule asphalt laying/repair work during non-smog season months (October to May).
- Keep all fuel-powered maintenance equipment working efficiently and repair any improper seals that may lead to fuel leaks or evaporative loss.

Landscaping

- Defer lawn mowing and the use of other fuel-powered landscaping equipment to non-smog alert days.
- Do not use pesticides on smog alert days; better still, eliminate pesticide use or establish pesticide reduction programs.

- Naturalize park and open areas wherever possible to reduce lawn cutting requirements.
- Use mulch or hard surface pathways in parks instead of grass to reduce lawn cutting.
- Ensure all fuel-powered landscape maintenance equipment is operating efficiently and repair any improper seals that may lead to fuel leaks or evaporative loss.

Procurement

- Establish a green fleet procurement policy to purchase alternative fuel-powered vehicles such as electrical, methanol and ethanol (mixtures containing not less than 85 per cent alcohol), natural gas or propane.
- Buy appliances with the Natural Resources Canada (NRCan), energy efficiency label.
- Buy electric-powered landscaping equipment where viable.
- Buy water-based paints, stains and sealers.
- When oil-based paints, stains and sealers must be purchased, make sure they have a low VOCs content that is clearly identified on the label.
- Take an inventory of diesel and traditional fuel vehicles and equipment, and identify options for upgrading or replacing them.

General

- Establish an employee education program to help inform staff about smog, its effects and the need for everyone to do his or her part to reduce or stop actions and lifestyle choices that generate harmful, smog-producing emissions.

Smog Alert
A Municipal Response Guide

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